# Discount rates used for forest valuation - results of 2011 survey

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## Summary

Eleven forest valuers responded to the survey and provided information on 14 New Zealand transactions between mid-2009 and 2011. The average reported IDR (implied discount rate) for each of these transactions was in the range 4.4 to 8.4% for post-tax cashflows and 7.8 to 10.6% for pre-tax cashflows. Overall averages were 6.7% (post-tax cashflows) and 9.3% (pre-tax cashflows), compared to 6.9% and 8.6% in the 2009 survey.

Forest valuers also provided the discount rate they use to estimate the market value of a forest. They are using discount rates for forest valuation that are on average 0.1% lower than in 2009.

## Introduction

Forest valuers were surveyed during the last quarter of 2011 about the discount rate used for forest valuation. The survey is an update of similar surveys carried out every two years since 1997 (Manley 1998, 1999, 2001, 2003, 2005, 2007, 2010).

## Method

A total of 11 forest valuers were surveyed and asked:

1. What method do you use to determine the market value of a forest?
2. When using the DCF (Discounted Cashflow or Expectation value) approach, what real discount rate do you use to estimate the market value of a tree crop?
3. What is the basis for deriving this rate?
4. How do you determine the log prices used?
5. How do you account for the cost of the use of land in valuing a tree crop?
6. Do you include cashflows from only the current crop?
7. When do you assume that cashflows occur?
8. Do you apply a stand-based or estate-based approach?
9. What specific allowance do you make for risk? Do you adjust the discount rate for forest-specific risk?

Valuers were also asked questions about valuation of the carbon trading opportunity:

10. What method do you use to determine the market value of the carbon trading opportunity?
11. What real discount rate do you use to estimate the market value of a tree crop?
12. How do you determine the carbon prices used?
13. What carbon trading strategy is assumed?
14. How do you account for the cost of the use of land in valuing carbon?

Forest valuers were also asked for transaction information:

15. What is your estimate of the discount rate implicit in the transaction price of recent (mid-2009 to 2011) forest sales.

Finally valuers were asked about factors relating to replanting and new planting decisions:

16. What real discount rate do you use to evaluate replanting or new planting investments?
17. What is your estimate of the internal rate of return on replanting or new planting?

## Responses to survey questions

### *1. Method used to determine the market value of a forest*

All 11 valuers use the DCF approach to determine the market value of a forest. Some valuers use a suite of approaches:

- Comparable sales, expectation approach, cost.
- Expectation value method, also liquidation value and replacement cost value.
- Future expectations (DCF) for most crops, replacement cost for very young crops, merged method as young crops grow older.

***Use of a cost-based approach***

Ten of the valuers sometimes use a cost-based approach in limited circumstances; particularly for valuing young stands; including:

- Some young crops that have commercial value and would have a zero or negative value if assessed by DCF.
- Young tree crops where there will be minimal stumpage because of the locality but there is a significant investment to realise carbon cashflows.
- Young stands and unusual species.
- Where a substantial proportion of the forest (say >70%) is at young ages (for radiata pine < 6 years). An influencing factor is whether the young component of the forest is in a discrete block that might be sold separately from the rest of the forest assets.

The definition of a young age varied from 2 to 14 years but the majority of valuers use a cut-off age of 5 years. One valuer uses the cost-based approach for stands aged 1 to 3 years and a merged cost/DCF approach for ages 4 to 7 years.

Follow up questions were asked of the ten valuers:

- Do you include indirect costs (eg, cost of supervision)?
  - Yes – 10
- Do you include overhead costs?
  - Yes – 8
  - Sometimes – 1
  - No - 1
- Do you include the cost of using the land for growing the tree crop?
  - Yes – 7
  - Sometimes – 1
  - No – 2
- Do you include the cost of time?
  - Yes – 8
  - No – 2

Valuers who include the cost of time invariably use a lower rate to compound costs than they do to discount cashflows in the DCF or expectation value approach. Typically a rate of 2 to 5% is used. Two valuers compound post-tax (rather than pre-tax) costs.

Comments on the rate:

- We use 5%. There is no detailed derivation behind this rate. It recognises that an astute and not especially willing vendor would try to get some return, but would be aware that they face a battle in trying to get a full rate. It also represents an attempt to keep the compounded cost figure from escalating too quickly.
- The use of replacement cost (compounded cost) values need to be tempered with the expectations for the future. If there is a fair likelihood of a profitable investment at prevailing market discount rates it is reasonable use the full compounding interest rate (this would still be a prudently conservative rate significantly lower than prevailing hurdle rates however). When future outcomes are much more uncertain or appear to offer poor prospects of a reasonable return judgment would be applied to the compound rate reducing it potentially to zero. Further if prospects look bleak there is little likelihood that the investor will recover the full costs expended. One way of doing this is to apply negative compound rates. Our normal method would however be to reduce the cost recovery to some fraction of the full costs expended.

One comment on overhead costs was:

- We see these as a prime candidate for adjustment in order to prevent a figure that looks uncomfortably high. The selection of which inputs to vary is not made arbitrarily – we try to picture how the negotiations between buyer and seller would proceed.

***2. Discount rate used to estimate the market value of a forest***

The response from each forest valuer is summarised in Table 1. Three valuers apply the DCF approach using only post-tax cashflows, seven valuers use only pre-tax cashflows, while one valuer uses both.

Valuers apply a discount rate in the range 6.8 to 8% (average 7.1%) to post-tax cashflows or a discount rate in the range 8 to 12% (average 8.7%) to pre-tax cashflows[1].

**Has the "market" discount rate changed since 2009?**

In the 2009 survey, the 14 respondents were applying an average discount rate of 7.3 % to post-tax cashflows and an average discount rate of 8.7 % to pre-tax cashflows.

Ten of the 11 valuers included in the 2011 survey

[1] *If a valuer responded with a range of discount rates, the midpoint discount rate was used to calculate averages.*

*Table 1 – Individual responses to survey questions*

| Respondent | Discount rate applied to post-tax cashflows | Discount rate applied to pre-tax cashflows | Basis for discount rate | Log prices based on | Cost of land based on |
|---|---|---|---|---|---|
| 1 | 7 | | IDR | 4Q | Market rental |
| 2 | 7 | 9-10 | Market/consistency | Current to 12Q over 5 years. | Market rental |
| 3 | | 8.5-10 | IDR & WACC/CAPM | Current to trend over 5 years. | Market rental or LMV |
| 4 | | 9-9.5 | CAPM/Survey | 18 month | Actual rental or 6% of LMV |
| 5 | | 7-8.5 large estates<br>8-12 other | IDR | Current to 20Q over 5 years | Market rental |
| 6 | | 8 | Consistency | 12Q | LEV |
| 7 | | 8-8.5 | IDR & WACC/CAPM | Forecast to long-term average | Market rental or 4-6% of LMV |
| 8 | 6.8 | | Survey | 12Q | LEV |
| 9 | 7-8 | | IDR/Survey | 4Q trending to 12Q | Market rental |
| 10 | | 8 | Consistency/Anecdotal | 12Q | 6% of LMV |
| 11 | | 8-9 | IDR/WACC | 4Q trending to forecast | LMV or Market rental |

also participated in the 2009 survey. Fig. 1 gives the frequency distribution of the change in discount rate. The average change is a reduction of 0.1%.

One valuer commented:

- For large estates in production, the rate we apply usually lies in the range 7% to 8.5% depending on risk profile. The median rate is 7.5% on pre-tax cashflows. There is evidence that the rate for these types of estates is now rising in the market.

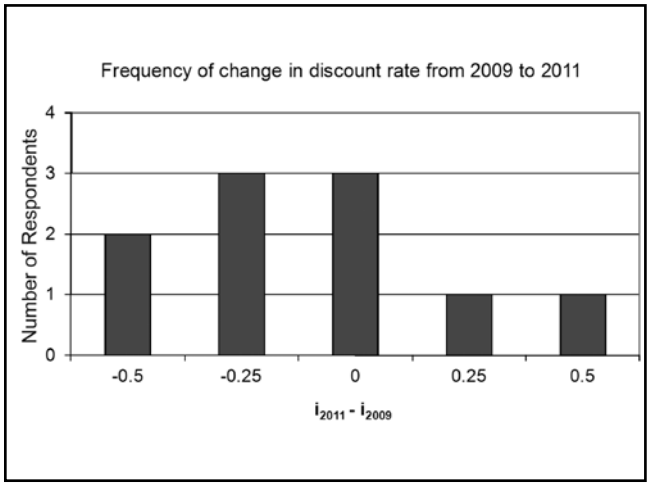


*Fig. 1: Frequency of change in discount rate from 2009 to 2011 for individual valuers.*

### *3. How is the discount rate selected?*

Valuers select discount rate based on a range of information sources. This information includes analysis of the discount rate implied by recent transactions (ie, the IDR or implied discount rate), WACC (Weighted Average Cost of Capital), or use of CAPM (Capital Asset Pricing Model). Some valuers select discount rate primarily on the basis of current industry practice using information from previous rounds of this survey or from other valuers. Consistency is also a consideration for some valuers.

***4. How are log prices determined?***

Many valuers use current prices or average prices for the last 4 quarters for the short-term with long-term prices (eg, after 5 years) predicted using average prices of the last 12 or 20 quarters. Some valuers use analysis and models to forecast long-term price trends.

Valuers customise published prices to the local region. For example, one valuer uses MAF prices but varies them if they are unrealistic for the region (such as pulp prices in the Wairarapa.)

***5. How is the cost of land accounted for in valuing a tree crop?***

Many valuers are using the general approach proposed in the 2007 Discussion Draft; ie, that the opportunity cost of occupying land with the current crop should be calculated as the market-based land rental. On leasehold land, the actual rental is commonly being used as the cost of land whereas for freehold land a notional land rental is being applied. This notional land rental is being estimated using a range of sources including:

- Forest land rentals including Crown Forestry Licence rentals.
- Market rentals for pastoral land.
- Land valuers.

Some valuers use more mechanistic approaches to account for the land cost when the land is freehold:

- One valuer uses the LEV (Land Expectation Value) to calculate the cost of land. Land rental is the product of LEV and the discount rate. This valuer assumes zero cost if the LEV is negative.
- One valuer uses the product of LMV (Land Market Value) and the discount rate.
- Three valuers use a percentage of LMV (4 to 6%) that is lower than the discount rate.

One valuer commented:

- Ideally the tree crop is charged with market rent, whether this is an actual rent or notional rent. In the absence of sufficient evidence we may apply either:
    - The LMV x a rate of approximately 5%.
    - A percentage of the LMV x the discount rate.

Both approaches are designed to reflect the premise that only part of the land's value is supported by the revenue-earning activity conducted upon it, and the balance by expectations of real capital appreciation or other factors.

***6. Do you include cashflows from only the current crop?***

All valuers include cashflows from only the current crop in the "base" valuation model. This is as required by accounting standard NZ IAS 41 [paragraph 22 states that "An entity does not include any cash flows for ….. re-establishing biological assets after harvest (for example, the cost of replanting trees in a plantation forest after harvest)].

One valuer includes future rotations when there is a requirement to replant. Other valuers deal with any obligation to replant in a range of ways:

- The value of future rotations is noted as an addition to or subtraction from land value.
- The value of future rotations is reported as an additional value or liability.

In some circumstances a valuation model including future rotations is also developed:

- To look at the returns that would be generated when the crop is replanted and to report the cashflows for a potential purchaser.
- For a feasibility analysis.
- To evaluate an investment.
- To determine stumpage shares under a multi-rotation lease.
- To determine the safe level of carbon.

***7. When do you assume that cashflows occur?***

A number of different conventions are assumed for the timing of cashflows:

| | |
|---|---|
| • Start of a period | 4 valuers |
| • Middle of a period | 6 valuers |
| • End of a period | 1 valuer |

***8. Do you apply a stand-based or estate-based approach?***

Three valuers follow a stand-based approach while four valuers adopt an estate-based approach. Four valuers use both approaches depending on the nature (size, age-class distribution) of the forest being valued.

### *9. Treatment of risk?*

Valuers use a range of approaches for incorporating risk into forest valuation.

- Sometimes a reduction in the order of 10 to 20% is made to cover the risk associated with volume and grade outturn for mature tree crops that are variable.
- If an input is poorly known then a conservative value is used for that input.
- We use Monte Carlo analysis to calculate the impact of risk and uncertainty in prices and costs. A 90% confidence range is determined.
- Risk is accommodated in the estimate of site index and in deriving expected yields by log type.
- Try to quantify the likely impact, apply area attrition, adjust yield tables and increase costs or include cost contingencies.
- Where possible we endeavour to quantify risk and include this in the cash flows (eg. fire, wind damage etc.) to the extent that we believe this has been done by market participants.

Six valuers sometimes make adjustments to the discount rate to allow for forest specific risk. For example:

- May apply a slightly higher rate if there are greater risks than would be considered typical.
- At times a higher rate is applied to more variable woodlots.
- Account for non-quantifiable risks through an adjustment to the discount rate. Rather subjective.
- Additional risk would only be included in the discount rate in the case of highly speculative and uncertain investments with no track record of either performance or transactions.
- Have undertaken catastrophic loss simulations and from these have developed some basis for adjusting the discount rate for fire or wind loss.

### *10. Method used to determine the market value of the carbon trading opportunity*

Eight of the valuers have valued the carbon trading opportunity (ie, the value of the opportunity to receive NZUs and the liability to surrender NZUs as carbon stocks increase or decrease) associated with a tree crop on post-1989 forest land.

DCF is the predominant method used. One valuer has "the opinion that the value associated with the carbon trading opportunity is attached to post-1989 land values. The level of carbon opportunity can be ascertained from the difference between the pre-1990 and post-1989 land values. As a cross-check I also run the expectation value approach from the carbon cashflows. The tree crop is separately assessed."

### *11. Discount rate used to estimate the market value of the carbon trading opportunity*

Discount rates used vary:

- We use the same discount rate as for the trees.
- At this stage, we tend to use the same discount rate as in valuing the timber content of the tree crop, but we are aware that there are grounds for a different rate. We have yet to sufficiently develop the arguments as to why it should be different from the timber crop rate, and/or find market evidence.
- 5-6% on pre-tax cashflows to reflect the cost of borrowing (which is what you are doing when selling carbon – you are borrowing against the future harvest revenue). This normally results in a lower carbon value than discounting at a forest discount rate, because the costs occur at the end of the rotation.
- We use the risk free rate. Carbon revenues are opposite to investment cash flows revenue arises now with a liability to repay at some time in the future. Therefore the receiver of the revenue must notionally invest this revenue in a risk free investment to guarantee having the income available to repay the liability in the future.
- We use 400 basis points higher than the tree crop discount rate. This is based on an opinion from a merchant banking group; pretty flimsy. It gels with our gut-feel in this very early part of the carbon era. The carbon cash flow is the reverse of most business cash flows: a series of returns followed by a cost. The higher the discount rate, the better the NPV in most cases; this is the perverse outcome.
- A range from 10 to 20% on pre-tax cashflows. Do not have market evidence to select a market implied rate.
- 15 to 20% on post-tax cashflows. The basis for deriving the rate is through attempting to reconcile the expectation value with the estimated carbon premium derived from the land value.

- Upon the recent decline in carbon values we would only use a high discount rate (say 10% plus); previously we used same discount rate as for logs/timber.

***12. How do you determine the carbon prices used***

Most valuers use current prices for carbon. One valuer uses a 1% annual price growth rate. Another valuer uses a conservative forecast of supply and demand recognising that there is great uncertainty around future prices.

***13. What carbon trading strategy is assumed?***

Four of the eight valuers assume that all carbon units available are traded annually. Other approaches are:

- For permanent forests, i.e. no harvesting envisioned, I assume 100% of carbon units are sold. For rotation forests I assume approximately 75% are sold.
- Sell up to the safe limit.
- We have assumed both that both all units are traded and that only "safe units" are traded – but we feel professionally 'happier' (providing more risk-averse advise) recommending the holding of some proportion of at-risk units.
- We run multiple scenarios including the scenario that all units are traded and the scenario that only "safe units" are traded.

***14. How is the cost of land accounted for in valuing the carbon trading opportunity?***

Only one valuer partitions land rental between the tree crop and carbon trading opportunity. One comment:

- The market rental that we use for post-1989 forest land in general is higher than for similar pre-1990 forest land, but we have not as yet partitioned between the tree crop and carbon trading opportunity.

***15. Discount rate implied by recent transactions***

Information provided by valuers on estimates of the implied discount rates in recent transactions is summarised in Table 2. A feature is the range of rates estimated by different valuers for some forests. The valuers providing these estimates clearly had different assumptions about some key inputs. This illustrates the requirement for consistency stated in the Guidance Notes on Discount Rate in the NZIF Forest Valuation Standard: "If a discount rate is derived using transaction evidence it should be derived using the same set of assumptions (taxation, borrowing, log prices, log price increases) as will be used in valuation of the target forest."

Also included in Table 2 is information on three recent Australian transactions.

## Replanting and new planting

***16. What discount rate do you use to evaluate replanting or new planting investments?***

Of the eight valuers who responded, five use the same discount rate as for forest valuation while three use a lower discount rate. One comment:

- We evaluate replanting and new planting investments by assessing the IRR, with or without carbon cashflows. We then compare the assessed IRR with IRRs of similar projects elsewhere. We do not assess the NPV of such investments.

***17. What is your estimate of the internal rate of return on new planting?***

There were only 5 responses to this question. One valuer provided an IRR based on post-tax cashflows:

- 5-6% for well-located crops (8-9% with carbon at $20/NZU).

Four valuers provided an estimate of IRR based on pre-tax cashflows:

- 3 to 4% (6 to 8% with carbon while it lasts).
- 3 to 4.5% at best.
- 4 to 6% at best.
- 5.5%.

## Discussion

***Number of respondents***

The number of respondents to the survey has dropped from 19 in 2007 to 14 in 2009 to 11 in 2011. This is a result of fewer individuals/organisations undertaking forest valuation on a routine basis[2]. The bulk of forest valuation in New Zealand is carried out by a few organisations; for example the IDR data presented in Table 2 was provided by only five respondents.

[2] *Only one valuer per organisation is included in the survey.*

*Table 2 - Estimates of the discount rate implicit in the transaction price of forests or interests in forests sold during mid 2009 to 2011. Forests are described by location and size class (Small <1000 ha; Medium 1000 to 10,000 ha; Large >10,000 ha).*

| **Forest** | **Number of respondents** | **Implied discount rate (applied to post-tax cashflows)** | **Implied discount rate (applied to pre-tax cashflows)** | **Carbon trading opportunity?[1]** |
|---|---|---|---|---|
| | | ***Average (range)*** | ***Average (range)*** | |
| 1. Small forest – Northland | 2 | 5.9 (5.5 – 6.4) | 8.4 (8 - 8.8) | |
| 2. Small forest – CNI | 1 | 7.0 | 9.6 | yes |
| 3. Small forest – East Coast | 1 | 7.0 | 9.6 | yes |
| 4. Small forest – East Coast | 1 | 7.0 | | yes |
| 5. Small forest – East Coast | 1 | 7.0 | | yes |
| 6. Small forest – Hawkes Bay | 1 | 7.0 | | yes |
| 7. Small forest – Wairarapa | 1 | 7.0 | | |
| 8. Small forest – Canterbury | 1 | 8.2 | 10.6 | |
| 9. Medium forest – Northland | 1 | 7.1 | 9.3 | |
| 10. Medium forest – East Coast | 2 | 5.4 (3.7 – 7.1) | 8.8 (7.9 - 9.7) | yes |
| 11. Medium forest – Marlborough | 2 | 8.3 (6.7 – 10.0) | 9.9 (7.9 – 12) | yes |
| 12. Medium forest – Canterbury | 1 | | 10.0 | |
| 13. Large forest – Northland | 4 | 6.2 (4.2 - 8.3) | 8.7 (5.5 – 12.4) | |
| 14. Large forest – NZ | 2 | 4.4 | 7.8 (6.5 – 9.2) | |
| | | | | |
| ***Australian transactions*** | | | | |
| Large forest – Queensland | 1 | | 8.7[2] | |
| Large forest – NSW | 1 | | 10.5 | |
| Large forest - Tasmania | 1 | | 7.5 | |

[1] *IDR calculation is based solely on cashflows for tree crop. In cases where a valuer considered that a premium had been paid for the carbon trading opportunity this was deducted from the purchase price and the tree crop IDR was derived from the residual value.*

[2] *This IDR is calculated using a perpetual cashflow model. The estimated IDR is 13.5% if only first rotation cashflows are included.*

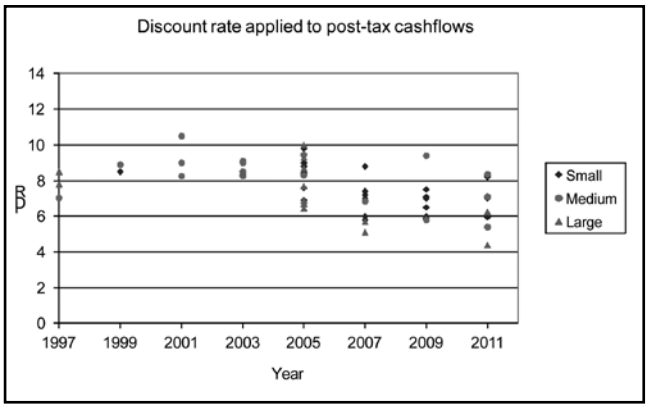


*Fig. 2: IDRs (applied to post-tax cashflows) for transactions reported in each of the eight discount rate surveys. Forests are identified by size class (Small <1000 ha; Medium 1000 to 10,000 ha; Large >10,000 ha).*

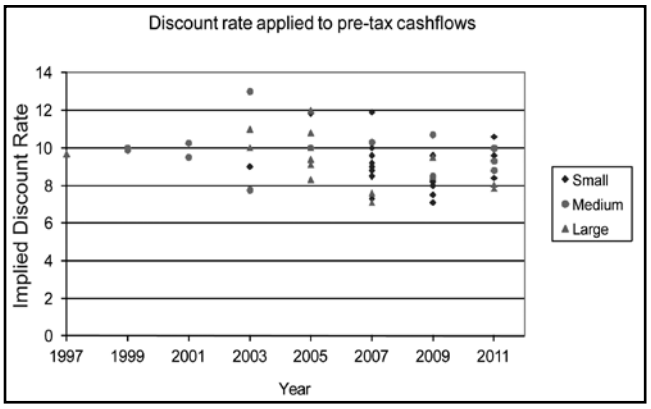


*Fig. 3: IDRs (applied to pre-tax cashflows) for transactions reported in each of the eight discount rate surveys. Forests are identified by size class (Small <1000 ha; Medium 1000 to 10,000 ha; Large >10,000 ha).*

### *Trends in discount rates*

Figs. 2 and 3 show the IDRs (applied to post-tax cashflows and pre-tax cashflows respectively) of transactions reported in all eight surveys to date[3]. Key features are:

- The range of IDRs (applied to post-tax cashflows) in the 2011 survey is 4.4 to 8.4% with an average of 6.7%. In the 2009 survey the range was 5.8 to 9.4% with an average of 6.9%.
- The range of IDRs (applied to pre-tax cashflows) in the 2011 survey is 7.8 to 10.6% with an average of 9.3%. In the 2009 survey the range was 7.1 to 10.7% with an average of 8.6%.
- Given the limited number of transactions (and the range in the IDR estimates both for a single transaction and between transactions), the overall conclusion would be that the distribution of discount rates in the 2011 survey is similar to that observed in the 2009 survey.

### *Alignment with IRR*

The estimates of IRR collected in this survey cover the range 3 to 6%. There is still a disconnect between the discount rates used for forest valuation in New Zealand and the IRR of new planting or replanting projects. The estimated IRR is typically less than the discount rate used for forest valuation.

One valuer's explanation of the disconnect:

> "IRR analysis indicates that most NZ forests are not capable of earning better than 5.5% (on pre-tax cashflows). Most industrial forests are being perpetuated, and this predates the introduction of deforestation penalties through the ETS. This could suggest some level of acceptance that the IRR is sufficient. On the other hand, the low level of new afforestation indicates that the rate should not be lower.

Those establishing new forests are in for the longer haul. They are in a different investor universe from those buying large tracts of existing forest. The funds for re-establishment are generally coming out of clearfelling returns. This is a different situation from trying to entice such funds from investors."

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[3] *IDRs for each transaction have been averaged in the cases where there was more than one respondent.*